ATTACHMENT A

Assessment Process

- Sponsorship:
- Resources provided by USIECR
- Guidance from Ad Hoc Subcommittee
- Conducted by Triangle Associates

Interviews

- Agency Representatives
  - Bureau of Reclamation
  - Franklin Conservation District
  - USGS
  - Department of Energy
  - US Fish and Wildlife Service
  - WA Department of Fish and Wildlife
- Elected Officials
- Native American and Tribal Government Representatives
- Environmentalists
- Agricultural Community
- Scientists/Contractors
- Other Interested Parties

Interview Results

- History of the issue from many perspectives
- List of technical reports, studies, and experts/specialists
- List of theories and questions

Literature Review

- Review of reports and studies summarizing published information about landslides
- Status of published information: dates and focus
- Information gaps

Technical Workshops

- Purpose
  - Update published information
  - Answer questions identified in the interviews
- Issues addressed in three categories
  - Geology and landslides
  - Water, groundwater and irrigated agriculture
  - Impacts to fish and habitat

Technical Workshops

- Criteria for workshop participant selection
  - Technical expertise or experience in the general subject area and/or relevant information for understanding the White Bluffs landslides
  - Representative of a broad range of perspectives interested in addressing the White Bluffs landslides
  - Balanced representation

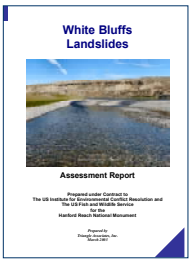
Technical Workshop Participants

Geology / Landslides	Water / Groundwater / Irrigated Agriculture	Fish and Habitat
•Robert Schuster *USGS* (Technical Facilitator) •Rex Baum *USGS* •Douglas Bennett *USBR* •Katyi Didricksen *USBR* •Karl Fecht *Bechtel* •Dan Hubbs *USBR* •Kevin Lindsey *KJC* •Mark Nielson *FCD* •Shannon McDaniel *SCBID*	•Robert Schuster *USGS* (Technical Facilitator) •Steve Cox *USGS* •Katyi Didricksen *USBR* •Dan Hubbs *USBR* •Kevin Lindsey *KJC* •Shannon McDaniel *SCBID* •Mark Nielson *FCD* •Paul Stoker *GWMA*	•Don Anglin *FWS* •Jeff Fryer *CRITFC* •Dave Geist *PNNL* •Paul Hoffarth *WDFW* •Ken Tiffan *USGS*

Process

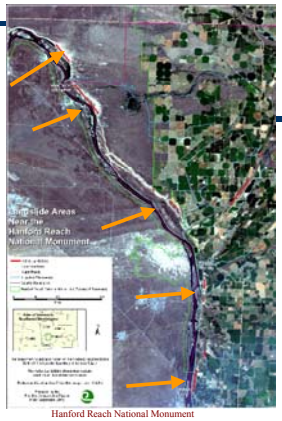
- Chapter on published information and discussion questions sent in advance
- Technical and process facilitators present
- Discussion of questions raised in interviews and development of recommendations
- Workshop draft summaries reviewed and revised by participants

Discussion Examples from the Report



- Questions
- Key Points from Discussion
- Conclusions

Landslide Areas Near Hanford Reach National Monument



Question 5: Do elevated groundwater levels contribute to landslides of the White Bluffs? If so, how?

- The answer to the question is yes, groundwater contributes to landslide activity, but it is not known how. To figure out how at each case requires an engineering analysis of slope angle, material strength, and pore pressures.
- No one generalization will work for all of the landslides because they are not the same. Each landslide is unique.

Major Conclusions

Geology/Landslides, Groundwater

- The similarities in the causes of landslides at different locations are that water is being added to the system and, in every case, water is a major contributing factor to slope instability.
- There is not adequate information about the underlying geology of the White Bluffs to characterize landslide hazards. If sufficient water is added to the fine-grained sediments of the Ringold Formation at the steep face of the White Bluffs, slope failure occurs in the form of landslides. However, the specific mechanisms and processes that form landslides along the bluffs are not known. There are not enough data to explain these results or to predict future landslide activity.

Major Conclusions

Geology/Landslides, Groundwater (cont)

- There is much that scientists, engineers, and others do not understand about the landslides along the White Bluffs. After reading the reports over the years, some people have assumed that enough information is known about landslides to implement remedial action. More work needs to be done to understand the controls, causes, and conditions of the landslides. This is not a simple problem and there are no simple solutions.

Major Conclusions

Fish and Habitat

- Participants at the workshop on impacts of landslides on fish and habitat said it was difficult to answer many of the questions posed to them about impacts of the landslides, for example, to prime salmon spawning habitat. They noted that, on an anecdotal or qualitative basis, one could identify changes to the plan form of the Columbia River or to certain gravel bars where people fish or changes visible in photos taken over the years. However, the researchers did not have quantitative information about where the sediment is coming from, where it is going to, or what it is doing.

Workshop Recommendations

1. Do not try to mitigate landslide activity until the causes of the landslides have been determined and mitigation measures have been evaluated.

Workshop Recommendations

2. Conduct a systematic inventory of the entire White Bluffs to lay out what is known about each landslide area.
   - Investigate and characterize the following categories:
     - Prehistoric landslides
     - Active landslides
     - Potential landslides

Workshop Recommendations

2. continued
   - Address detailed, specific questions about causes and do not make assumptions as to the immediate cause(s) of landslides. A study should address if:
     - The problem is a seep line 100 feet below the bluff or 200 feet below the bluff;
     - It is a single or multiple seep system;
     - The system is dry or saturated.

Workshop Recommendations

2. continued
   - Identify data and information gaps for each area.
   - Create a matrix that identifies the types of landslides; the causes /mechanisms of the landslides -- all the conditions at each landslide area.

Workshop Recommendations

2. continued
   - Identify potential impacts: erosion to farmland; increased sedimentation in the Columbia River; impacts to cultural resources; low/no impacts, etc.
   - Once the geologic and hydrologic controls of the system are well defined, alternative actions to mitigate landslides can be determined and a preferred alternative implemented.
   - Assign priority areas of study based on the results.

Workshop Recommendations

3. Conduct an engineering evaluation at the WB 10 Pond/Wiehl Ranch landslide area. This would determine the impact of the water on the slopes – today and in the future. What would happen if nothing were done?

Workshop Recommendations

4. Initiate a more systematic, long-term monitoring network.
   - Expand the well system for monitoring.
   - Consolidate data from current and past groundwater monitoring sources: USGS, SCBID, USBR.
   - Include SCBID's recording device data; check winter data when groundwater is the primary source, rather than irrigation water, for hints about groundwater.

Workshop Recommendations

5. Establish an ongoing dialogue about the White Bluffs landslides.
   - Make this workshop the start of a continuing dialogue on landslides along the White Bluffs among interested parties.
   - Begin to share information about ongoing programs, field activities, and data interpretations.

Workshop Recommendations

6. Identify a single entity to compile information on activities that address landsliding along the White Bluffs.
   - This would permit developing a comprehensive understanding of what is being done by different agencies.

Workshop Recommendations

7. Coordinate efforts to avoid duplication.
   - Additional studying, monitoring, and collaboration of efforts are needed to understand what is happening and to develop a consistent long-term view.

Workshop Recommendations

8. Establish baseline data now.
   - To monitor redd locations
   - To measure sediment composition and water quality
   - To measure landslide sediment impacts on sloughs and the river
   - Use of aerial photography to document and study change over time

Workshop Recommendations

9. Provide opportunities for researchers working on the landslides, the river, and fish habitat to share information

Subcommittee Recommendations for Committee Consideration